Zoonotic Diseases and Direct Marketing of Game Meat: Aspects of Consumer Safety in Germany

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Berlin-Dahlem
History of BfR

- Kaiserliches Gesundheitsamt (1876-1919)
- Reichsgesundheitsamt (1919-45)

Federal Ministry for Youth, Family Affairs and Health (1952-1994)
Federal Institute for Health Protection of Consumers and Veterinary Medicine (1994-2002)

6. August 2002
Economical relevance of game meat

Sources of game meat in Germany

- Hunting: 34,000 tons per year
- Import: 4,000 tons per year
- Game farming: 35,000 tons per year

(total ca. 73,000 tons)
34,943 tons of game produced in the hunting season 2007/2008 corresponds to a total of 1,664,824 animals

~ 19,000 tons (477,494 wild boar), ~ 11,000 tons (1,075,358 roe deer),
~ 4,000 tons (59,422 red deer), ~ 1,700 tons (52,550 fallow deer)

<table>
<thead>
<tr>
<th>Species</th>
<th>kg</th>
<th>Euro/kg</th>
<th>Euro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red deer</td>
<td>3.716.000</td>
<td>4.5</td>
<td>16.722.000</td>
</tr>
<tr>
<td>Fallow deer</td>
<td>1.705.000</td>
<td>5</td>
<td>8.525.000</td>
</tr>
<tr>
<td>Wild boar</td>
<td>18.576.000</td>
<td>4</td>
<td>74.304.000</td>
</tr>
<tr>
<td>Roe deer</td>
<td>10.946.000</td>
<td>5</td>
<td>54.730.000</td>
</tr>
<tr>
<td>total</td>
<td>34.943.000</td>
<td></td>
<td>154.281.000</td>
</tr>
</tbody>
</table>
Game: 1.3% (0.8 kg/ head/yr) of total meat consumption in Germany

• traditionally regarded as a delicatessen
• wins increasing consumer interest in recent years

• very popular with consumers because it is
  - generated without chemical additives (in face of environmental contamination...)
  - regarded as a fresh product

• increasing consumption trend of today's society, trust in natural products as healthy
  mistrust in the quality of meat produced from domestic animals due to husbandry practices, growth promotors, meat scandals
Meat of wild boars can contain Alaria alata

Advice for hunter in handling of wild game

Guideline for sensoric testing of game
Perfluorooctanesulfonic acid (PFOS)

**Problem:** contamination of wild game with PFOS (especially liver)
no systematic survey about PFOS in food is available
(detected also in fish)

**Source:** soil conditioner, fertilizer and further unknown sources

**TDI:** 0,1 µg/kg Bodyweight

**Open questions:** Detection of PFOS Sources and incidence in food

**First consequences:** prohibition of consumption of wild boar liver in
some parts of Mecklenburg-Vorpommern
Human cases of infections regarding game meat

- Outbreaks in context of game meat consumption not reported (except Trichinellosis and Tularaemia, see below)

- Cases occurs relating to (e.g.)
  - Trichinella
  - Escherichia Coli (STEC)
  - Hepatitis E
  - Francisella tularensis
Trichinella-Situation in Germany

- 1-10 registered cases of Trichinella in human per year (mostly imported contamination)

- Occasionally Trichinella-outbreaks occur through meat from wild boars or domestic pigs (last major outbreak in 2006 in Mecklenburg-Vorpommern with contamination of 16 persons)

- 425,64 million slaughtered pigs (1997-2006)
  → nur 1 positive Trichinella-tested (2003)

- Regular Trichinella-findings in wild boars during official meat inspections

- Sporadical inspections for Trichinella in indicating animals (esp. foxes, raccoon dogs)
Hunting statistics wild boar, fox (D, 1997-2006)

Germany large populations nationwide of wild boar and fox

Quelle: www.jagdonline.de
Increasing numbers, main focus north-eastern states (Mecklenburg-Vorpommern and Brandenburg)

Quelle: www.jagdonline.de
### Hunting bag and positive findings (wild boar, 1991-2006)

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
<th>tested</th>
<th>(%)</th>
<th>positive</th>
<th>prevalence (%)</th>
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</thead>
<tbody>
<tr>
<td>1991</td>
<td>312768</td>
<td>215494</td>
<td>68,90%</td>
<td>6</td>
<td>0,0028</td>
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<tr>
<td>1992</td>
<td>248898</td>
<td>160901</td>
<td>64,65%</td>
<td>12</td>
<td>0,0075</td>
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<tr>
<td>1993</td>
<td>339242</td>
<td>214426</td>
<td>63,21%</td>
<td>20</td>
<td>0,0093</td>
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<tr>
<td>1994</td>
<td>313214</td>
<td>201442</td>
<td>64,31%</td>
<td>26</td>
<td>0,0129</td>
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<tr>
<td>1995</td>
<td>253788</td>
<td>179385</td>
<td>70,68%</td>
<td>13</td>
<td>0,0072</td>
</tr>
<tr>
<td>1996</td>
<td>362214</td>
<td>251656</td>
<td>69,48%</td>
<td>10</td>
<td>0,0040</td>
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<tr>
<td>1997</td>
<td>281916</td>
<td>215926</td>
<td>76,59%</td>
<td>14</td>
<td>0,0065</td>
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<tr>
<td>1998</td>
<td>251431</td>
<td>192764</td>
<td>76,67%</td>
<td>12</td>
<td>0,0062</td>
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<tr>
<td>1999</td>
<td>418667</td>
<td>292460</td>
<td>69,86%</td>
<td>9</td>
<td>0,0031</td>
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<tr>
<td>2000</td>
<td>350976</td>
<td>265417</td>
<td>75,62%</td>
<td>8</td>
<td>0,0030</td>
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<tr>
<td>2001</td>
<td>531887</td>
<td>389008</td>
<td>73,14%</td>
<td>4</td>
<td>0,0010</td>
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<tr>
<td>2002</td>
<td>512050</td>
<td>397425</td>
<td>77,61%</td>
<td>12</td>
<td>0,0030</td>
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<tr>
<td>2003</td>
<td>470283</td>
<td>370187</td>
<td>78,72%</td>
<td>10</td>
<td>0,0027</td>
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<td>2004</td>
<td>476042</td>
<td>390570</td>
<td>82,05%</td>
<td>11</td>
<td>0,0028</td>
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<tr>
<td>2005</td>
<td>476645</td>
<td>402996</td>
<td>84,55%</td>
<td>11</td>
<td>0,0027</td>
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<tr>
<td>2006</td>
<td>287080</td>
<td>272258</td>
<td>94,80%</td>
<td>8</td>
<td>0,0029</td>
</tr>
</tbody>
</table>

Quelle: Bundesamt für Statistik (Fachserie 3, Reihe 4.3)
The wildlife STEC reservoir

A few reports are available on wild life animals as carriers of STEC, and some of these serve as food source for humans.
Shiga toxin producing Escherichia coli (STEC)

STEC contamination in meat from wildlife animals equal or higher than in food from domestic animals.

Presence of STEC in food frequently associated with the producer animal

Slaughter practices and hygiene play a major role in contamination of meat with STEC

Are STEC present in higher proportions in game than in domestic animals?

Is the high contamination of wildlife meat with STEC caused by improper slaughter practices?
Most STEC positive samples are found in sheep meat (11.1%).

Game is in 2nd position (9.9%)!

Beef is far behind (5.2%).

Pork samples are least STEC contaminated (0.7%).

STEC strains

• 140 STEC from wildlife meat samples in Germany (1998 to 2006)
  → wild boar (n=18)
  → deer (n=110)
  → hare (n=8)
  → other (n=4)

• 101 STEC strains from other sources
  → farm animals (cattle, sheep and goat) (n=44),
  → food except game (meat, milk and cheese) (n=23)
  → human patients (n=34)
Salmonella

• Transmittal of isolates to NRL-Salm

All materials from 1998 - 05.09 total: 51,410
Isolates from game                2,230 (4.3%)
Hare                         2
Red deer                   5
Rabbit                    61
Roe deer                  13
Wild boar                59

• Meat inspection (2006, esp. testing on Salmonella)
  taken samples 18, positives 0

• Game meat from retail (2006)
  taken samples 897, positives 41 (4.56%)
Salmonella

• Important serovares (1998 - 05. 2009)

  • S. Typhimurium, total 2023 isolates
    – pigeon 1,936
    – rabbit 52
    – roe deer 7
    – wild boar 10

  • S. Enteritidis, total 71 isolates
    – game (non dif.) 48
    – red deer 2
    – roe deer 3
    – wild boar 6
    – pigeon 8
Hepatitis E

Hepatitis E virus – zoonotic genotypes

HEV

- genotype 1: Asia, Africa
- genotype 2: Mexico, Nigeria, Chad
- genotype 3: worldwide → pig, wild boar, Sika deer
- genotype 4: Asia ← pig
Hepatitis E

New study: HEV in Wild Boars in Germany

- 22/148 (14.9%) positive (real-time PCR)

Berlin/Potsdam: 3/73 (4.1%)
Brandenburg: 14/54 (25.9%)
Thuringia: 5/21 (23.8%)
Hepatitis E

- HEV is broadly distributed among German wild boars
- differences in detection rate in urban vs. rural regions
- no age-related differences in detection rates
- different sub-types cluster according to their geographical origin
- high nucleotide sequence identity between wild boar strain wbGER27 and human strain indicate direct virus transmission
- first genome sequence of a genotype 3i strain (wbGER27) was determined
Hepatitis E

• The results indicate that wild boars have to be considered as a major reservoir for HEV in Germany.

• A risk of HEV transmission to humans is present in rural as well as in urban regions.

• Wild boars of every age may be considered as potentially infected.

• Risk of transmission for hunters, but also due to undercooked wild boar meat.

• Availability of more HEV full-length genome sequences will enable a more detailed identification of routes of HEV transmission.
Tularaemia

*Francisella tularensis* (rabbit fever)

**Reservoir:**

F. tularensis is found in different small mammals (hare, rabbit, mice, rats, squirrels), or environment (water, soil).

Infection via contact to contaminated environment or parasites (ticks, flies, mosquitoes)


Legal aspects of game meat hygiene

**National regulation on meat hygiene §10a (up to 2006):**
Large wild game with hide transported to a game-handling establishment
Storage at +7°C / 9 days, or +1°C / 17 days

**Regulation (EC) 853/2004: (since 2006)**
Large wild game:
Stomachs and intestines removed as soon as possible, transported to a game-handling establishment as soon as possible, temperature maximum +7°C as soon as possible
European and national food law regarding game meat

direct marketing:

• (Basic-) Reg. (EC) 178/2002:
  • Hunters, who supply game to third-parties, are primary producers and therefore food traders
  • Game is a food product
  • Food products must be safe for consumption („food products are considered unsafe, if health damage could occur after consumption and/or if unsuitable for consumption“)

• LFGB:
  • It is prohibited, to produce food products in such a way that health damage is caused upon consumption

• „Tier-LMHV“:
  • No meat inspection in cases of
    – direct delivery
    – small numbers („hunting bag of one day“)
    – radius of 100 km
    – no lesions
    – mandatory testing on Trichinella (wild boar)
    – hunter is „trained person“
Exposure Assessment

Occurrence of microorganism in the environment, in animals (e.g. zoonotic agents), in foods

Influence of food processing

Behaviour of microorganism in the food chain, number of bacteria in food

Treatment of food in households

Consumption studies
Elements of Safety Strategy in Handling Game Meat

<table>
<thead>
<tr>
<th>Species</th>
<th>Numbers of meat inspections</th>
<th>Not good for consumption whole carcass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red deer</td>
<td>10,772</td>
<td>91</td>
</tr>
<tr>
<td>Fallow deer</td>
<td>9,732</td>
<td>88</td>
</tr>
<tr>
<td>Roe deer</td>
<td>75,286</td>
<td>619</td>
</tr>
<tr>
<td>Wild boar</td>
<td>92,129</td>
<td>1,222</td>
</tr>
<tr>
<td>Others</td>
<td>1,144</td>
<td>38</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td><strong>189,036 (11%)</strong>*</td>
<td><strong>2,058 (1%)</strong></td>
</tr>
<tr>
<td>Testing on Trichinella</td>
<td>282,442</td>
<td>9</td>
</tr>
<tr>
<td>Samples taken by hunters</td>
<td>125,468</td>
<td></td>
</tr>
</tbody>
</table>

statistics of meat inspection large wild game 2007 (*hunting bag 2007 total of 1,664,824 animals)

Elements of Safety Strategy in Handling Game Meat

• Training courses for hunters:

- since 2006 accordance with Regulation (EC) 853/2004 and national regulation „Tier-LMHV“, 114,000 hunters in Germany participated in further education, certificated as „trained persons“.

- lecture courses to gain hunting licenses in 1987 and later are also accepted as equivalent education level.

- increasing numbers of facilities for hygienic handling in relation to hunting:
  - chilling chambers
  - special boning rooms
  - drinking water
  - illumination
TPC on different starting points of chilling (roe deer)

Hygiene rules
- Cooling

Log\(_{10}\) 3,5 CFU/cm\(^2\)

Log\(_{10}\) 5,0 CFU/cm\(^2\)
Profiles of microbial growth (TPC, roe deer) during chilling, different air temperatures

GKZ: Vergleich verschiedener Kühltemperaturen

Log$_{10}$ 5,0 CFU/cm$^2$

Log$_{10}$ 3,5 CFU/cm$^2$
Traceability

Documentation and identification mark

- 100 km radius
- small amount
- direct trade
- trained person
Conclusions

• Direct marketing of game meat is of increasing importance in Germany

• Monitoring zoonotic diseases are important in regard to consumer safety

• Level of education of hunters is increasing

• Hygienic handling is important for health of game meat (cooling etc.)
Thank you for your attention:
Questions?

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